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(54) **CROSS-NETWORK QUALITY-OF-SERVICE VERIFICATION**

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(52) **U.S. Cl.** **370/349**; 370/395.21

(58) **Field of Classification Search** None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,621,793	B2 *	9/2003	Widgren et al.	370/230.1
7,106,718	B2 *	9/2006	Oyama et al.	370/340
2002/0101859	A1 *	8/2002	Maclean	370/352
2003/0053464	A1 *	3/2003	Chen et al.	370/400
2005/0144327	A1	6/2005	Rabie et al.	
2007/0116004	A1 *	5/2007	Kang et al.	370/395.2
2008/0112363	A1 *	5/2008	Rahman et al.	370/331

OTHER PUBLICATIONS

Steven Blake, et al., "An Architecture for Differentiated Services," Dec. 1998, pp. 1-37, Torrent Networking Technologies, Morrisville, North Carolina; EMC Corporation, Hopkinton, Massachusetts; Sun Microsystems, Inc., Boulder, Colorado; Nortel UK, Harlow, Essex, United Kingdom; <http://tools.ietf.org/html/rfc2475>.

Kathleen Nichols, et al., "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers," Dec. 1998, pp. 1-21, Cisco Systems, San Jose, California; Torrent Networking Technologies, Morrisville, North Carolina; Cisco Systems, Santa Barbara, California; EMC Corporation, Hopkinton, Massachusetts; <http://tools.ietf.org/html/rfc2474>.

K.K. Ramakrishnan, et al., "The Addition of Explicit Congestion Notification (ECN) to IP," Sep. 2001, pp. 1-64, TeraOptic Networks, Inc.; ACIRI; EMC Corporation, Hopkinton, Massachusetts; <http://tools.ietf.org/html/rfc3168>.

* cited by examiner

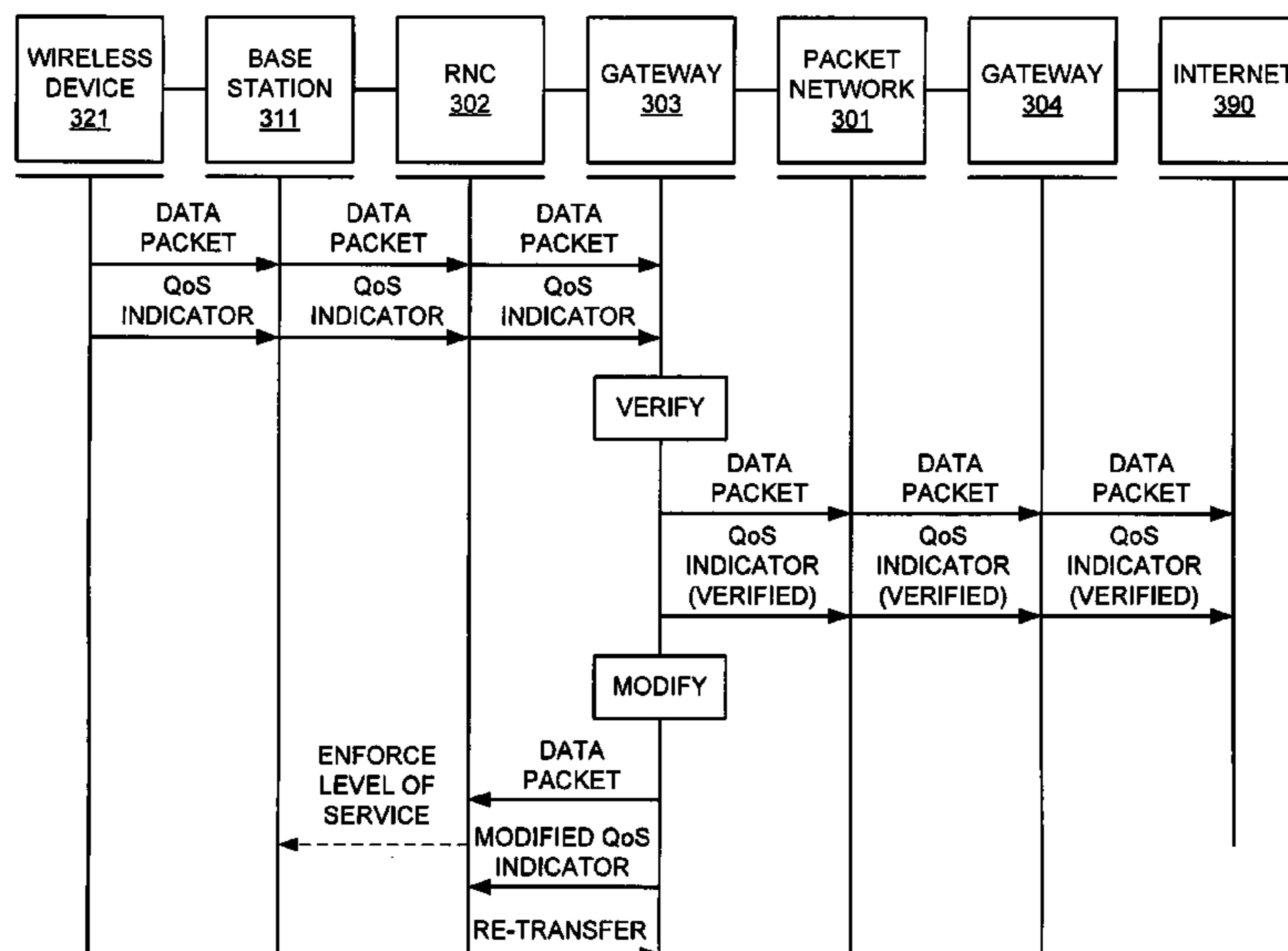
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(57) **ABSTRACT**

What is disclosed is a system and method wherein a wireless access system configured to receive a data packet with a first quality-of-service indicator value from a wireless device over a wireless link, provide a first level of service to the wireless device over the wireless link based on the first quality-of-service indicator, and transfer the data packet with the first quality-of-service indicator. The communication system includes a core packet network configured to receive the data packet with the first quality-of-service indicator and determine if the first quality-of-service indicator is consistent with a quality-of-service policy for the wireless device. The core packet network is configured, if the first quality-of-service indicator is not consistent with the quality-of-service policy for the wireless device, to determine a second quality-of-service indicator consistent with the quality-of-service policy for the wireless device, and transfer the data packet with the second quality-of-service indicator. The wireless access system is configured to receive the data packet with the second quality-of-service indicator, and provide a second level of service to the wireless device over the wireless link based on the second quality-of-service indicator.

20 Claims, 5 Drawing Sheets



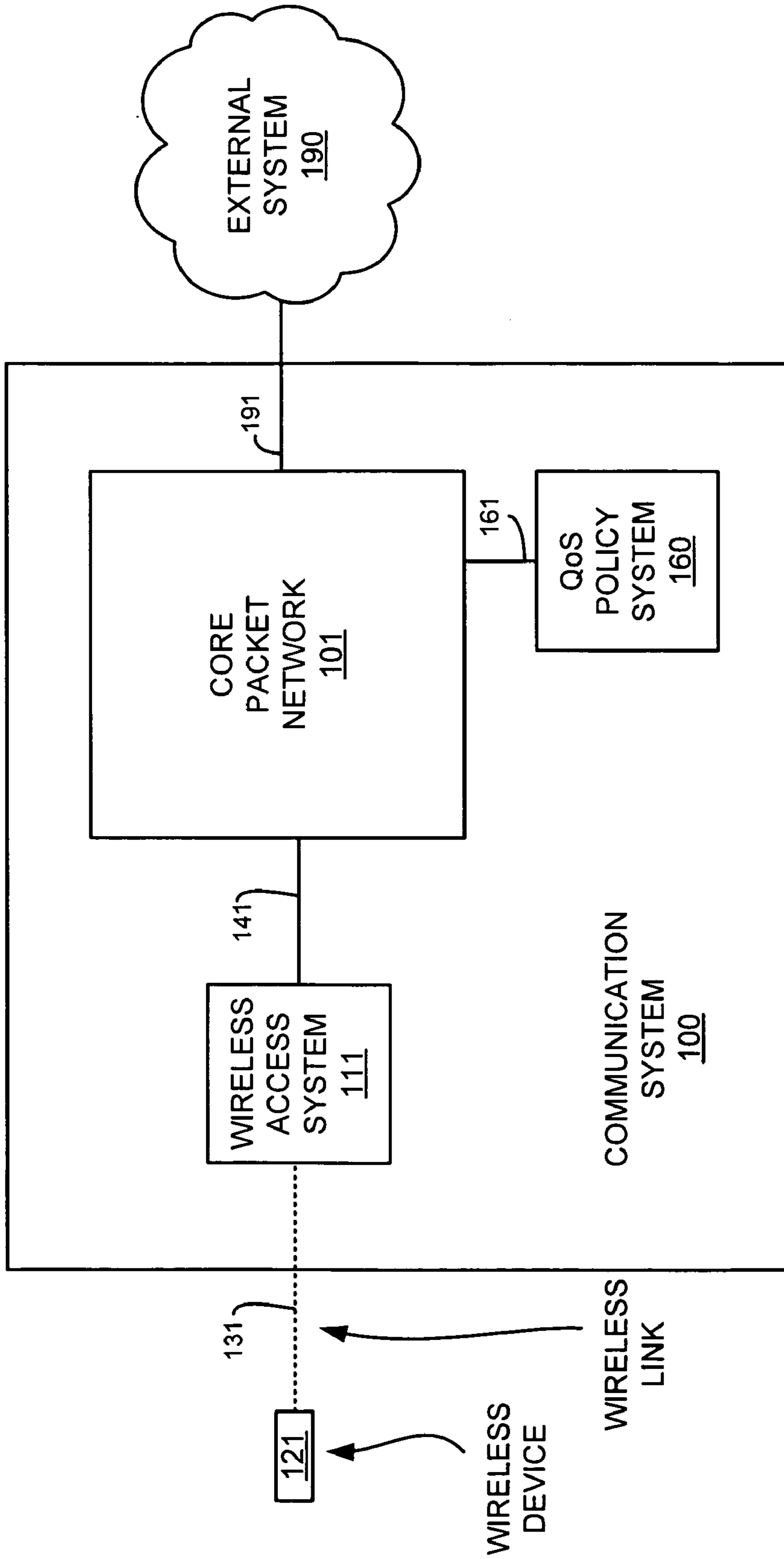


FIGURE 1

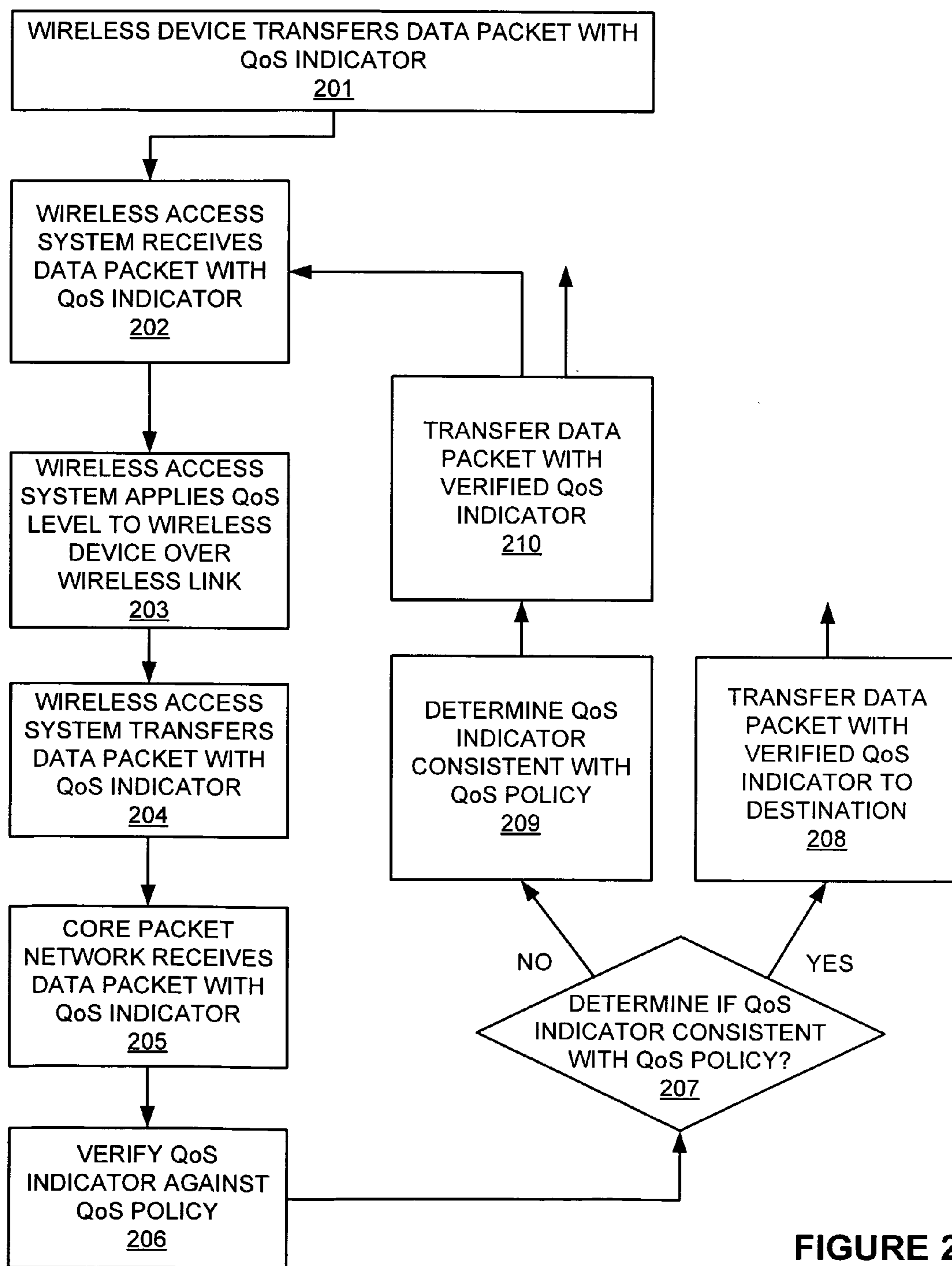


FIGURE 2

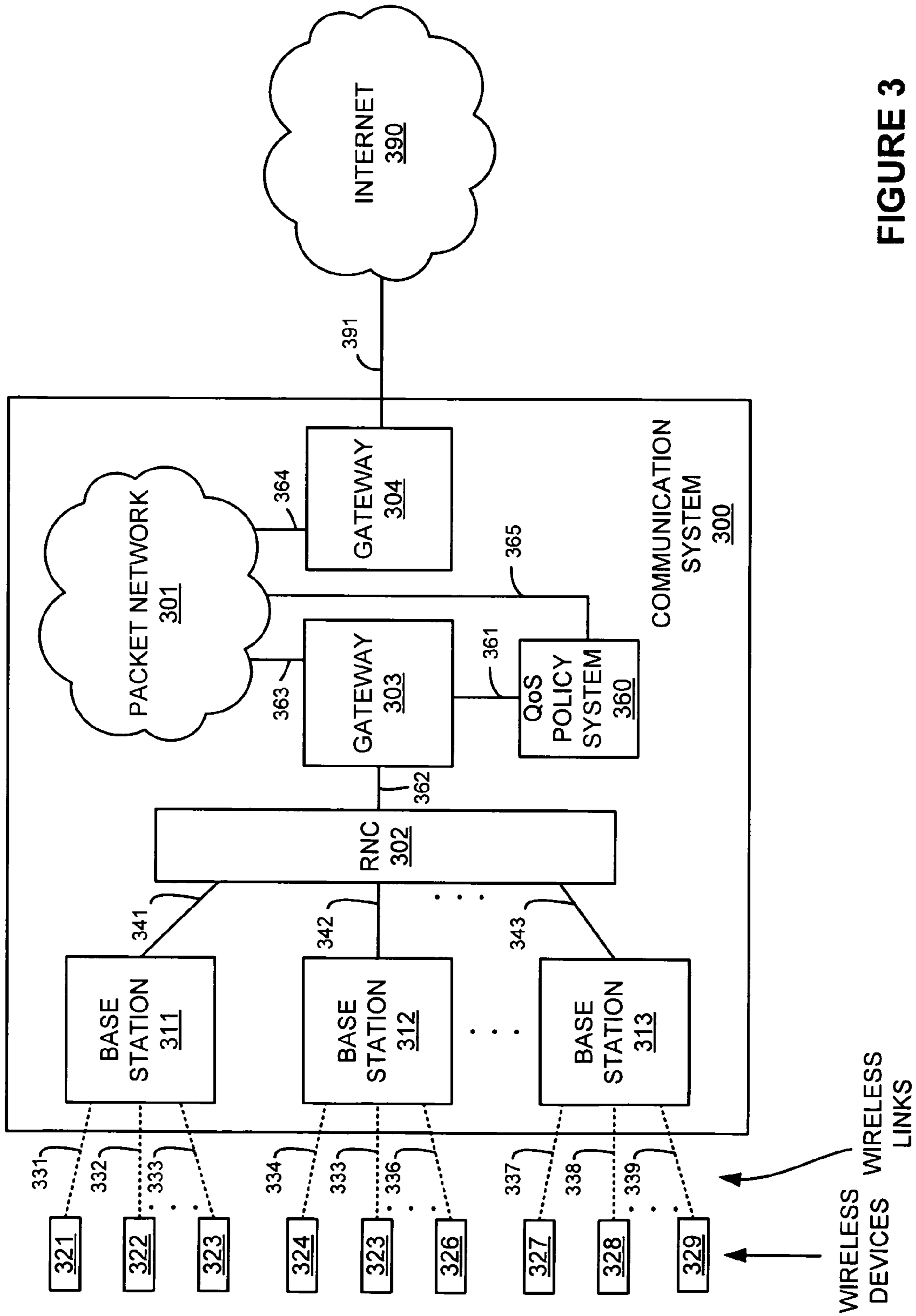


FIGURE 3

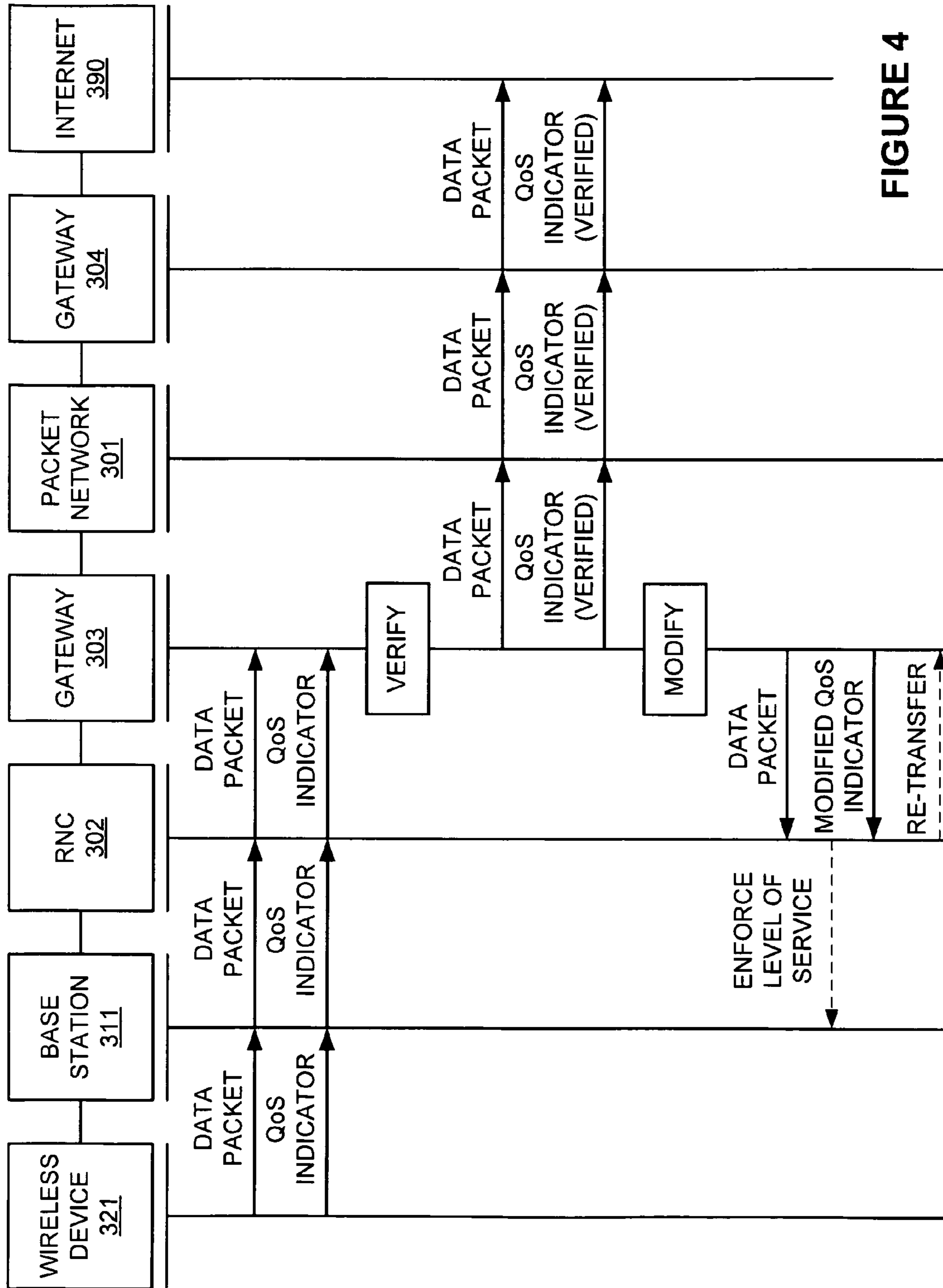


FIGURE 4

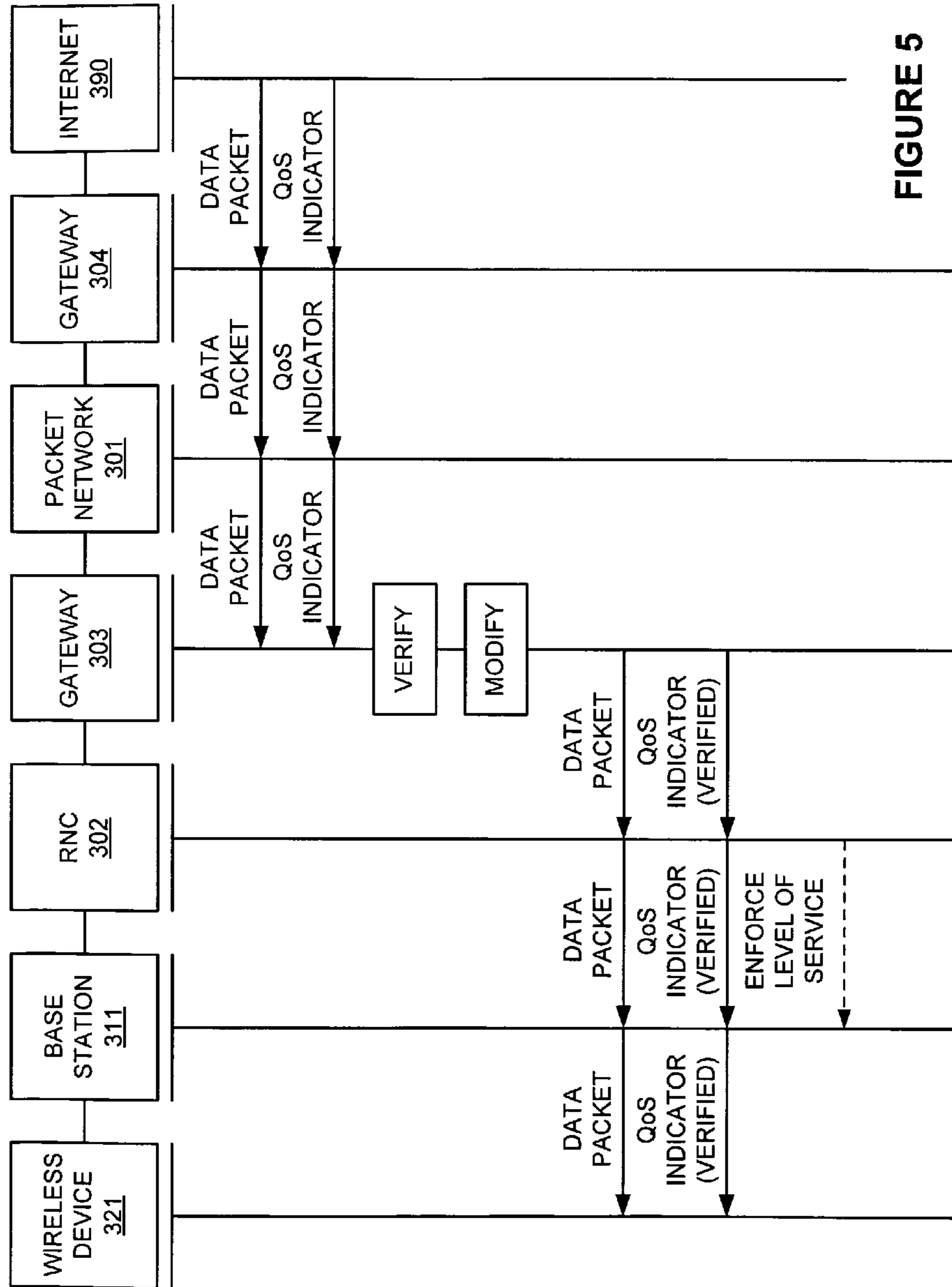


FIGURE 5

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CROSS-NETWORK QUALITY-OF-SERVICE
VERIFICATION

TECHNICAL BACKGROUND

Data packets transferred across computer networks can contain various indicators to notify network equipment, such as gateways and routers, as to status and properties of the data. One indicator is a quality-of-service (QoS) indicator, the value of which indicates to network equipment the level of service a data packet should receive. This can be useful in packet-based networks, such as the Internet, where data packet transmission times are highly variable and dependent upon traffic patterns and congestion. The level of service correlating to a particular quality-of-service indicator value can be based upon many factors, some of which include network congestion status, data traffic type (i.e. video or email), or by agreement between the network provider and the data originator or recipient.

One example quality-of-service indicator is the Differentiated Services Code Point (DSCP) field in the header of IP data packets. Another example is the Multi Protocol Label Switching (MPLS) prefix which can contain a quality-of-service indicator. These quality-of-service indicators can indicate to network equipment a level of service that a data packet should receive when passing through such network equipment.

OVERVIEW

A communication system is disclosed which includes a wireless access system configured to receive a data packet with a first quality-of-service indicator value from a wireless device over a wireless link, provide a first level of service to the wireless device over the wireless link based on the first quality-of-service indicator, and transfer the data packet with the first quality-of-service indicator. The communication system includes a core packet network configured to receive the data packet with the first quality-of-service indicator and determine if the first quality-of-service indicator is consistent with a quality-of-service policy for the wireless device. The core packet network is configured, if the first quality-of-service indicator is not consistent with the quality-of-service policy for the wireless device, to determine a second quality-of-service indicator consistent with the quality-of-service policy for the wireless device, and transfer the data packet with the second quality-of-service indicator. The wireless access system is configured to receive the data packet with the second quality-of-service indicator, and provide a second level of service to the wireless device over the wireless link based on the second quality-of-service indicator.

Another example is a method of operating a communication system, which includes, in a wireless device, transferring a data packet with a first quality-of-service indicator over a wireless link. The method includes, in a wireless access system, receiving the data packet with the first quality-of-service indicator, applying a first level of service to the wireless device over the wireless link based on the first quality-of-service indicator, and transferring the data packet with the first quality-of-service indicator. The method includes, in a core packet network, receiving the data packet with the first quality-of-service indicator and determining if the first quality-of-service indicator is consistent with a quality-of-service policy for the wireless device. If the first quality-of-service indicator is not consistent with the quality-of-service policy for the wireless device, determining a second quality-of-service indicator consistent with the quality-of-service policy

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for the wireless device, and transferring the data packet with the second quality-of-service indicator. The method includes, in the wireless access system, receiving the data packet with the second quality-of-service indicator, and providing a second level of service to the wireless device over the wireless link based on the second quality-of-service indicator.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, like reference numerals designate corresponding parts throughout the several views.

FIG. 1 is a system diagram illustrating a communication system.

FIG. 2 is a flow diagram illustrating a method of operation of a communication system.

FIG. 3 is a system diagram illustrating a communication system.

FIG. 4 is a sequence diagram illustrating a sequence of operation of a communication system.

FIG. 5 is a sequence diagram illustrating a sequence of operation of a communication system.

DETAILED DESCRIPTION

FIG. 1 is a block diagram that illustrates communication system 100. Communication system 100 includes core packet network 101, wireless access system 111, and quality-of-service (QoS) policy system 160. FIG. 1 also shows wireless device 121 and external system 190. Wireless device 121 and wireless access system 111 communicate over wireless link 131. Wireless access system 111 and core packet network 101 communicate over link 141. Core packet network 101 and quality-of-service policy system 160 communicate over link 161. Core packet network 101 and external system 190 communicate over link 191.

Wireless device 121 includes a telephone, transceiver, computer, digital assistant, Internet appliance, or some other wireless communication apparatus—including combinations thereof. Wireless access system 111 and core packet network 101 can be any type of communications network equipment capable of receiving and transmitting data packets. Wireless access system 111 includes a radio node controller (RNC), wireless base station, wireless access point, telephone switch, Internet router, network gateway, or some other type of communication equipment—including combinations thereof. Core packet network 101 could include routers, switches, gateways, servers, or some other type of communication network or equipment—including combinations thereof. Quality-of-service policy system 160 comprises a computer system or special purpose circuitry which may include a storage system, database, user service profile directory, or some other type of directory or listing—including combinations thereof. Quality-of-service policy system 160 could be located within core network 101, or located remotely from core network 101. External system 190 could include an Internet network, wireless network, telephony network, optical network, enterprise network, local area network, or some other type of communication network or communication device—including combinations thereof.

Wireless link 131 uses the air or space as the transport media. Wireless link 131 could use various protocols, such as wireless fidelity (WiFi), code division multiple access (CDMA), worldwide interoperability for microwave access (WiMAX), Internet, Internet protocol (IP), local-area network (LAN), telephony, or some other communication format—including combinations thereof. Links 141, 161, and 191 use various communication media, such as air, metal,

optical fiber, or some other signal propagation path—including combinations thereof. Links **141**, **161**, and **191** use various protocols, such as Internet, Internet protocol, local-area network, telephony, optical networking, wireless communication, wireless fidelity, code division multiple access, worldwide interoperability for microwave access, or some other communication format—including combinations thereof. Links **141**, **161**, and **191** could be direct links or it might include various equipment, intermediate components, systems, and networks.

Data packets are transferred between wireless device **121** and wireless access system **111** over wireless link **131**. Data packets received in wireless access system **111** can be transferred to core packet network **101** or back to wireless device **121** over wireless link **131**. Core packet network **101**, for example, can transfer data packets between wireless access system **111** over link **141** and external system **190** over link **191**, or back to wireless access system **111**.

FIG. 2 is a flow diagram that illustrates a method of operation of communication system **100**. In FIG. 2, wireless device **121** transfers (**201**) a data packet with a first quality-of-service (QoS) indicator over wireless link **131**.

Wireless access system **111** receives (**202**) the data packet with the first quality-of-service indicator. Wireless access system **111** applies (**203**) a first level service to wireless device **121** over wireless link **131** based upon the first quality-of-service indicator. Wireless access system **111** transfers (**204**) the data packet with the first quality-of-service indicator over link **141**. A level of service can be granted to the data packets in transit through communication system **100**. This level of service could be indicated by a quality-of-service indicator in a data packet in transit on communication system **100**. The level of service given to the data packets can vary on the communication medium, the level of service purchased by a user, or other factors. For example, the level of service given to wireless device **121** over wireless links **131** could be based upon wireless power level, allotted timeslots and scheduling in the wireless communication channels, data rate allowances, data type priority (for example, voice versus data), relegating wireless device **121** to a particular frequency or channel when communicating over wireless link **131**, or other factors—including combinations thereof.

Core packet network **101** receives (**205**) the data packet with the first quality-of-service indicator. Core packet network **101** then verifies (**206**) the first quality-of-service indicator against a quality-of-service policy for wireless device **121**. Core packet network **101** then determines (**207**) if the first quality-of-service indicator is consistent with the quality-of-service policy for wireless device **121**. This determination includes retrieving the quality-of-service policy for wireless device **121** from quality-of-service policy system **160**. If the first quality-of-service indicator is not consistent with the quality-of-service policy for wireless device **121**, core packet network **101** determines (**209**) a second quality-of-service indicator consistent with the quality-of-service policy. Core packet network **101** transfers (**210**) the data packet with the second (verified) quality-of-service indicator over link **141**.

Wireless access system **111** receives (**202**) the data packet with the second quality-of-service indicator. Wireless access system **111** then applies (**203**) a second level of service to wireless device **121** over wireless link **131** based upon the second quality-of-service indicator.

There are various ways of handling the data packet after receipt by wireless access system **111**. For example, wireless access system **111** could re-transfer (**204**) the data packet with second quality-of-service indicator over link **141**. The above

method of operation of communication system **100** repeats when core packet network **101** receives the data packet with the second quality-of-service indicator and operates as discussed above. In another example, wireless access system **111** could discard the data packet received with second quality-of-service indicator instead of re-transferring (**204**). In another example, wireless access system **111** could transfer another communication packet to core packet network **101** to acknowledge receipt of the second quality-of-service indicator.

Once the quality-of-service indicator, as received by core packet network **101**, is consistent with the quality-of-service policy for wireless device **121**, core packet network transfers (**208**) the data packet with the verified quality-of-service indicator. Core packet network could be further configured to apply a level of service to the data packet consistent with the verified quality-of-service indicator. The data packet and verified quality-of-service indicator are transferred, possibly to external system **190** over link **191**, depending upon the destination of the data packet. The data packet could also be transferred to any number of other destinations, including wireless access systems **111** over link **141**.

It should be understood that the above description of FIG. 2 could occur in a different order than or in combined steps herein described in order to achieve proper operation of communication system **100**.

FIG. 3 is a block diagram that illustrates communication system **300**. Communication system **300** includes packet network **301**, radio node controller (RNC) **302**, gateways **303** and **304**, base stations **311-313**, and quality-of-service (QoS) policy system **360**. FIG. 3 also shows wireless devices **321-329** and Internet **390**. Wireless devices **321-323** and base station **311** communicate over wireless links **331-333**. Wireless devices **324-326** and base station **312** communicate over wireless links **334-336**. Wireless devices **327-329** and base station **313** communicate over wireless links **337-339**. Base stations **311-313** and radio node controller **302** communicate over links **341-343**. Radio node controller **302** and gateway **303** communicate over link **362**. Gateway **303** and packet network **301** communicate over link **363**. Gateway **303** and quality-of-service (QoS) policy system **360** communicate over link **361**. Gateway **304** and packet network **301** communicate over link **364**. Packet network **301** and quality-of-service (QoS) policy system **360** communicate over link **365**. Gateway **304** and Internet **390** communicate over link **391**. It should be understood that a different number of wireless devices could communicate with a base station, a different number of base stations could communicate with radio node controller **302**, and a different number of radio node controllers could communicate with gateway **303**.

For example, data packets originating in wireless device **321** can be transferred over wireless link **331** to base station **311**. Such data packets received in base station **311** can be transferred to packet network **301** through radio node controller **302** and gateway **303**. Packet network **301**, for example, can transfer data packets with gateways **303** and **304** over links **363** and **364**, respectively. Gateway **304** can transfer data packets with Internet **390** over link **391**.

Wireless links **331-339** use the air or space as the transport media. Wireless links **331-339** could use various protocols, such as wireless fidelity (WiFi), code division multiple access (CDMA), worldwide interoperability for microwave access (WiMAX), Internet, Internet protocol (IP), local-area network (LAN), telephony, or some other communication format—including combinations thereof. Links **341-343**, **361-365**, and **391** use various communication media, such as air, metal, optical fiber, or some other signal propagation path—

including combinations thereof. Links **341-343**, **361-365**, and **391** use various protocols, such as Internet, Internet protocol, local-area network, telephony, optical networking, wireless communication, wireless fidelity, code division multiple access, worldwide interoperability for microwave access, or some other communication format—including combinations thereof. Links **341-343**, **361-365**, and **391** could be direct links or it might include various intermediate components, systems, and networks. Furthermore, link **361** could also be a logical link between gateway **303** and quality-of-service policy system **360**, and be configured as a software or hardware interface, or some combination thereof.

A level of service can be granted to the data packets in transit through communication system **300**. This level of service could be indicated by a quality-of-service indicator in a data packet in transit on communication system **300**. The level of service given to the data packets can vary on the communication medium, the level of service purchased by a user, or other factors. For example, the level of service given to wireless device **321** over wireless links **331** could be based upon wireless power level, allotted timeslots and scheduling in the wireless communication channels, data rate allowances, data type priority (i.e. voice versus data), relegating wireless device **321** to a particular frequency or channel when communicating over wireless link **331**, or other factors—including combinations thereof.

The level of service corresponding to the quality-of-service indicator could be handled on a wireless device basis or on a customer or user basis. In some cases, no distinction is made between the wireless device and the user of the wireless device, whereas in other cases, a distinction could be made.

Quality-of-service policy system **360** comprises a computer system or special purpose circuitry which may include a storage system, database, user service profile directory, or some other type of directory or listing—including combinations thereof. Quality-of-service policy system **360** could be located within packet network **301**, or located remotely from packet network **301**.

FIG. **4** is a sequence diagram that shows an example sequence of operation of communication system **300** as illustrated in FIG. **3**. A data packet originates in wireless device **321** and is accompanied by a first quality-of-service (QoS) indicator. The data packet could contain any number of different varieties of data types. For example, the data packet could contain data including video, audio, email, textual, or chat data, or contain web page traffic, or be a Voice over IP (VoIP) packet. The quality-of-service indicator can be sourced from wireless device **321** as a function of the configuration of wireless device or may be indicated by a user of wireless device **321**.

Wireless device **321** transfers the data packet and first quality-of-service indicator over wireless link **331**. The level of service given to the data packets over link **331** can vary on the communication medium, the level of service purchased by a user, or other factors. For example, the level of service given to wireless device **321** over wireless links **331** could be based upon wireless power level, allotted timeslots and scheduling in the wireless communication channels, data rate allowances, data type priority (i.e. voice versus data), relegating wireless device **321** to a particular frequency or channel when communicating over wireless link **331**, or other factors—including combinations thereof.

Base station **311** receives the data packet and the first quality-of-service indicator. Base station **311** gives wireless device **321** a level of service over wireless link **331** consistent with the first quality-of-service indicator. Base station **311** then transfers the data packet and first quality-of-service indi-

cator. Radio node controller **302** receives and transfers the data packet and first quality-of-service indicator.

Gateway **303** receives the data packet and first quality-of-service indicator. In gateway **303**, the first quality-of-service indicator is checked against a quality-of-service policy for wireless device **321**. Gateway **303** can accomplish this checking, for example, by identifying wireless device **321** and then retrieving the quality-of-service policy from quality-of-service policy system **360** over link **361**. Gateway **303** could also retrieve the quality-of-service policy from quality-of-service policy system **360** over link **365** by way of packet network **301**.

If the first quality-of-service indicator, as received by gateway **303**, is not consistent with the quality-of-service policy for wireless device **321**, then the quality-of-service indicator is modified to a second quality-of-service indicator to be consistent with the quality-of-service policy for wireless device **321**. The data packet with the second quality-of-service indicator (now modified and verified) is then transferred back to radio node controller **302**.

Radio node controller **302** receives the data packet with the second quality-of-service indicator. Radio node controller **302** then enforces a second level of service to wireless device **321** over wireless link **331** based upon the second quality-of-service indicator. This enforcement of the proper level of service can be accomplished, for example, by relaying to base station **311** the second quality-of-service indicator, or by directly controlling base station **311**, among other methods. Radio node controller **302** could further re-transfer the data packet with second quality-of-service indicator over link **362**.

Once the quality-of-service indicator, as received by gateway **303**, is consistent with the quality-of-service policy for wireless device **321**, gateway **303** could be further configured to apply a level of service to the data packet consistent with the verified quality-of-service indicator and transfer the data packet with the verified quality-of-service indicator. The data packet and verified quality-of-service indicator are transferred, possibly to Internet **390**, depending upon the destination of the data packet. The data packet could also be transferred to any number of other destinations, including base stations **311-313**. The data packet then receives a level of service in gateways **303** and **304**, packet network **301**, and over links **362**, **363**, **364**, and **391** consistent with the verified quality-of-service indicator.

When gateway **303** transfers the data packet with the second (now verified) quality-of-service indicator back over link **362**, the data packet with the second quality-of-service indicator could be received on a different interface of radio node controller **302** from which the data packet with the first quality-of-service indicator was transferred, or could be received on the same interface. For example, the different interface could be a different cable, wire, port, or input on radio node controller **302**. If the data packet is received on a different port on radio node controller **302**, for example, this would indicate to radio node controller **302** that the quality-of-service indicator has been adjusted and level of service of certain wireless links should be modified accordingly. The data packet could also include such information or payloads as the destination and source addresses, a new quality-of-service indicator, or other indicators to allow radio node controller **302** to recognize the data packet indicates a new quality-of-service is requested for a specific wireless device or wireless link.

The data packet received by gateway **303** with the first quality-of-service indicator could be the same data packet that gateway **303** transfers with the second quality-of-service indicator back over link **362** and received by radio node controller **302**. The data packet with the second quality-of-

service indicator transferred by gateway **303** back over link **362** could also be encapsulated by another data or communications packet, or the second quality-of-service indicator alone can be transferred in a special purpose communications packet over link **362** and received by radio node controller **302**.

It should be understood that any number of data packets originating in wireless devices **321-329** could simultaneously be transferred over their respective wireless links **311-313**. Radio node controller **302** and gateway **303** could then receive these data packets and handle according to the methods and operations as described herein. Also, data packets originating in packet network **301** or Internet **390** would receive similar treatment on passage through system **300** when destined for equipment in system **300** or wireless devices **321-329**.

Although not required, in some examples of the quality-of-service indicator, the quality-of-service indicator includes the Differentiated Services Code Point (DSCP) field in an IP data packet header. In other examples, a Multi Protocol Label Switching (MPLS) prefix of a data packet could contain a quality-of-service indicator.

Advantageously, a communication system as described herein can monitor and verify the quality-of-service indicator to prevent a data packet from receiving the wrong level of service. An unintentional or intentional manipulation of the quality-of-service indicator (for example, the DSCP field or MPLS prefix) can have the effect of a data packet receiving the wrong level of service than it should. This can lead to a customer using packet-based equipment in a communication system receiving a different priority scheduling or port selection, among other service factors, and a customer using wireless-based equipment in a communication system receiving different power allowances, channel allotment, or frequency selections, among other service factors. This could lead to the customer receiving a higher level of service than purchased or to less efficient use of network equipment.

FIG. **5** is a sequence diagram that shows an example sequence of operation of communication system **300** as illustrated in FIG. **3**. A data packet, which indicates a destination of wireless device **321**, originates in Internet **390** with a possibly unverified, first quality-of-service (QoS) indicator. The quality-of-service indicator could be sourced, for example, from a user, equipment, or service provider communicating with Internet **390**.

The data packet is then transferred via gateway **304** through packet network **301**. The data packet receives a level of service in gateways **304**, packet network **301**, and over links **363**, **364**, and **391** consistent with the unverified, first quality-of-service indicator.

Gateway **303** receives the data packet and first quality-of-service indicator. Gateway **303** would recognize that the data packet is bound for wireless device **321**. In gateway **303**, the first quality-of-service indicator then is verified against a quality-of-service policy for wireless device **321**. Gateway **303** can accomplish this verification, for example, by identifying wireless device **321** and then retrieving the quality-of-service policy from quality-of-service policy system **360** over link **361**. Gateway **303** could also retrieve the quality-of-service policy from quality-of-service policy system **360** over link **365** by way of packet network **301**.

If the first quality-of-service indicator, as received by gateway **303**, is not consistent with the quality-of-service policy for wireless device **321**, then the quality-of-service indicator is modified to a second quality-of-service indicator to be consistent with the quality-of-service policy for wireless device **321**. The data packet with the second quality-of-ser-

vice indicator (now modified and verified) is then transferred over link **362**. The data packet receives a level of service in gateways **303** and over link **362** consistent with the verified, second quality-of-service indicator. If the first quality-of-service indicator, as received by gateway **303**, is consistent with the quality-of-service policy for wireless device **321**, then the data packet is transferred without modification to the quality-of-service indicator.

Radio node controller **302** receives the data packet with the quality-of-service indicator. Radio node controller **302** then enforces a level of service to wireless device **321** over wireless link **331** based upon the quality-of-service indicator as received. This enforcement of the proper level of service can be accomplished, for example, by relaying to base station **311** the quality-of-service indicator, or by directly controlling base station **311**, among other methods. If radio node controller **302** controls base station **311** directly, in some examples, the quality-of-service indicator might not be transferred further.

Base station **311** receives the data packet and possibly the quality-of-service indicator. Base station **311** gives wireless device **321** a level of service over wireless link **331** consistent with the quality-of-service indicator. Base station **311** then transfers the data packet and possibly the quality-of-service indicator over wireless link **331**.

Wireless device **321** receives the data packet and possibly the quality-of-service indicator over wireless link **331**. The level of service given to the data packets over link **331** can vary on the communication medium, the level of service purchased by a user, or other factors. For example, the level of service given to wireless device **321** over wireless links **331** could be based upon wireless power level, allotted timeslots and scheduling in the wireless communication channels, data rate allowances, data type priority (i.e. voice versus data), relegating wireless device **321** to a particular frequency or channel when communicating over wireless link **331**, or other factors—including combinations thereof.

FIGS. **1-5** and the previous descriptions depict specific embodiments to teach those skilled in the art how to make and use the best mode. For the purpose of teaching inventive principles, some conventional aspects have been simplified or omitted. Those skilled in the art will appreciate variations from these embodiments that fall within the scope of the invention. Those skilled in the art will also appreciate that the features described above can be combined in various ways to form multiple embodiments. As a result, the invention is not limited to the specific embodiments described above, but only by the claims and their equivalents.

What is claimed is:

1. A communication system, comprising:

a wireless access system configured to receive a data packet with a first quality-of-service indicator value from a wireless device over a wireless link, provide a first level of service to the wireless device over the wireless link based on the first quality-of-service indicator, and transfer the data packet with the first quality-of-service indicator for delivery to a core packet network;

the core packet network configured to receive the data packet with the first quality-of-service indicator and determine if the first quality-of-service indicator is consistent with a quality-of-service policy for the wireless device;

the core packet network configured, if the first quality-of-service indicator is not consistent with the quality-of-service policy for the wireless device, to determine a second quality-of-service indicator consistent with the quality-of-service policy for the wireless device, and

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transfer the data packet with the second quality-of-service indicator to the wireless access system for redelivery;

the wireless access system configured to receive the data packet with the second quality-of-service indicator, provide a second level of service to the wireless device over the wireless link based on the second quality-of-service indicator, and transfer the data packet with the second quality-of-service indicator for delivery to the core packet network.

2. The communication network of claim 1, wherein the core packet network is further configured to identify the wireless device and retrieve a quality-of-service policy for the wireless device.

3. The communication network of claim 2, wherein the first quality-of-service indicator comprises a Differentiated Services Code Point (DSCP) field of a header of the IP packet.

4. The communication network of claim 2, wherein the first quality-of-service indicator is contained within a Multi Protocol Label Switching (MPLS) prefix.

5. The communication network of claim 1, wherein if the first quality-of-service indicator is consistent with the quality-of-service policy for the wireless device, the core packet network further configured to apply a third level of service to the data packet consistent with the first quality-of-service indicator and transfer the data packet with the first quality-of-service indicator.

6. The communication network of claim 1, wherein the data packet comprises an IP packet.

7. The communication network of claim 1, wherein the wireless access system comprises a radio node controller.

8. The communication network of claim 1, wherein the quality-of-service policy for the wireless device is contained within a user service profile directory.

9. The communication network of claim 1, wherein the core packet network comprises an IP network.

10. The communication network of claim 1, wherein if the first quality-of-service indicator is not consistent with the quality-of-service policy for the wireless device, the core packet network further configured to encapsulate the data packet and the second quality-of-service indicator in a communication packet and transfer the communication packet containing the data packet and the second quality-of-service indicator to the wireless access system for redelivery.

11. A method of operating a communication system, comprising:

- in a wireless device, transferring a data packet with a first quality-of-service indicator over a wireless link;
- in a wireless access system, receiving the data packet with the first quality-of-service indicator, applying a first level of service to the wireless device over the wireless link based on the first quality-of-service indicator, and transferring the data packet with the first quality-of-service indicator for delivery to a core packet network;
- in the core packet network, receiving the data packet with the first quality-of-service indicator and determining if

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the first quality-of-service indicator is consistent with a quality-of-service policy for the wireless device;

wherein if the first quality-of-service indicator is not consistent with the quality-of-service policy for the wireless device, determining a second quality-of-service indicator consistent with the quality-of-service policy for the wireless device, and transferring the data packet with the second quality-of-service indicator to the wireless access system for redelivery;

in the wireless access system, receiving the data packet with the second quality-of-service indicator, providing a second level of service to the wireless device over the wireless link based on the second quality-of-service indicator, and transferring the data packet with the second quality-of-service indicator for delivery to the core packet network.

12. The method of operating the communication system of claim 11, further comprising: in the wireless access system, identifying the wireless device and retrieving a quality-of-service policy for the wireless device.

13. The method of operating the communication system of claim 12, wherein the first quality-of-service indicator comprises a Differentiated Services Code Point (DSCP) field of a header of the IP packet.

14. The method of operating the communication system of claim 12, wherein the first quality-of-service indicator is contained within a Multi Protocol Label Switching (MPLS) prefix.

15. The method of operating the communication system of claim 11, wherein if the first quality-of-service indicator is consistent with the quality-of-service policy for the wireless device, applying a third level of service to the data packet consistent with the first quality-of-service indicator, and transferring the data packet with the first quality-of-service indicator.

16. The method of operating the communication system of claim 11, wherein the data packet comprises an IP packet.

17. The method of operating the communication system of claim 11, wherein the wireless access system comprises a radio node controller.

18. The method of operating the communication system of claim 11, wherein the quality-of-service policy for the wireless device is contained within a user service profile directory.

19. The method of operating the communication system of claim 11, wherein the core packet network comprises an IP network.

20. The method of operating the communication system of claim 11, wherein if the first quality-of-service indicator is not consistent with the quality-of-service policy for the wireless device, encapsulating the data packet and the second quality-of-service indicator in a communication packet and transferring the communication packet containing the data packet and the second quality-of-service indicator to the wireless access system for redelivery.

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